STEAM AND HYDRAULIC SAFETY ELEVATORS.

In large cities, where every inch of land is precious, the modern power elevator has virtually effected for building, what the locomotive engine has effected for travel and transportation—namely, a revolution. Hotels, office buildings, apartment houses, and first-class stores, are now almost invariably carried to a height of eight or ten stories, and equipped with elevators; while a tendency is fast growing and will soon become controlling, to increase the value of third and fourth rate property in the same way, and even to eliminate the toil of stair-climbing from ordinary housekeeping. This great change in the conditions of living, together with the progressive fatality already developed, as elevators without adequate safeguards begin to wear and weaken, will soon be calling in terrible tones for legislative interference. Fortunately, there are standard safety appliances that have stood the test of every possible description of breakage and accident to which elevators are liable, during a quarter of a century past, without a single failure. The sole reason that we hear from time to time of cruel destruction to human life from the falling of elevators in our hotels and apartment houses, etc., is that there are proprietors too parsimonious, or too ignorant, to provide their buildings with the perfect and proved safeguards that are everywhere before their eyes in the standard pattern of elevators used in nearly all of the most valuable buildings. They ought to be compelled to do so, whoever may profit or lose by the requirement. Meanwhile, let us see what individuals can do to protect themselves against these people by avoidance.

The improved modern safety device, introduced by Otis Brothers & Co., in their best elevators, for some years past, is quite outside and independent of the other mechanism, and acts instantaneously by virtue of any acceleration of the standard rate of motion in the car, from whatever cause. Both arrangement and action are simplicity itself. There is an independent sheave at the top and another at the bottom of the hoist well or shaft, and an endless wire rope running around the two; the lower sheave being suspended, to keep the rope taut. The rope is connected at a proper point with the safety catches on the car, in such a manner as to run the rope as the car moves, and thus to run a pair of governor balls geared to the top sheave. If the car should commence descending faster than the rate for which the governor is set—whether by accident, by overloading, or by indiscretion of the operator—the extension of the governor balls by the accelerated motion (greatly multiplied on the governor) instantly operates a clutch on the rope which pulls out the catches into the safety ratchets, and stops and locks the car in its place. It is like an automatic iron hand, always ready to clutch and pull the rope that arrests the car, the moment it disobeys the set restriction on its rate of descent. It is literally impossible by any means to move the car downward faster than the rate prescribed.

HYDRAULIC ELEVATORS.

For the purpose most interesting to the general reader—that of passenger elevators—the very recently perfected application of hydraulic power has controlling advantages, and it is probable that most pasaenger elevators will hereafter be constructed on this principle. The best hydraulic elevators are preferred to steam for this purpose on account of the perfect smoothness of their motion, their remarkable simplicity of construction and operation, easy management, and reduced opportunities for breakage, derangement or accident. To these advantages they add that of reduced expense for motive power to the extent of the head of water available on the premises. It is not to be understood, however, that all hydraulic elevators share in this preference. Most kinds heretofore, in fact have cost more in wear and tear of ropes and other parts, and in motive power to overcome extra friction, weight, &c., than any kind of steam elevators.

We shall make it our object to put the reader in possession of the leading criteria and principles necessary for a correct judgment among different hydraulic elevators in the remainder of this article.

Generally the less desirable kinds of hydraulic elevators are made with a short cylinder of large diameter, into which the pressure of a heavy column of water is introduced at one end, urging a solid piston like that of a steam engine from that end to the other. The piston rod pushes forward a crosshead bearing on each side of it a block of multiplying sheaves or pulleys around which the wire rope (from the sheave at the top of the hoist) passes, and returns many times to and from a similar pair of multiplying blocks in a fixed position at the rear of the cylinder. As these blocks of sheaves are thus forced farther apart by the motion of the piston, lengthening each of the twenty turns (more or less) of the wire rope between them, a length of rope many times the length of the piston stroke is obviously thus taken up, and the car is hoisted an equivalent distance. It is the same in effect as winding up the rope on a drum: but it is not so favorable in mode; the friction and strain being excessively increased. Moreover, the course of the wire rope from sheave to sheave in the blocks, must necessarily cross the plane of revolution of each sheave, both in taking and leaving it, so that the edge of every groove continually and severely rasps the rope as it runs into it and out of it under a tension of tons force. In point of fact, these ropes have to be frequently renewed, not only at considerable expense, but at much inconvenience from interruption. But a worse result is their great liability to snap suddenly at some point, and not only throw the enormous tension out of balance and the labyrinth of rope and blocks into violent snarl and wreck, to the destruction of everything animate or inanimate within reach; but at the same time, to cause the car to fall the whole distance to which it may have been raised. Another objection, of course, is the constant extra cost of power for the extreme friction peculiar to this mode of multiplying motion. The substitution of a rack of cog teeth on the piston rod, gearing into a pinion wheel, and that into a geared winding drum, does not mend the matter in point of safety or economy, since it is not practicable to use a belt from so slow a motor. Some of this class of machines are made doubly objectionable by placing the cylinder horizontally. The lift weight of a vertical piston can be counterbalanced; but this arrangement makes a nett increase of friction by the dead weight of the heavy piston to be dragged on the bottom side of the cylinder. Two other disadvantages are not to be avoided or counteracted: the constant wear of the cylinder and piston out of round by dragging the latter on its under side, and the accumulation under it of sediment from the water, to assist in the work of abrasion.

We conclude with a description of the more modern and matured form of hydraulic elevator, adopted for the Government buildings, on the unanimous recommendation of a board of experts appointed by the Secretary of the Treasury, and composed of Messrs. Frederick Graff, C. E., of Philadelphia; Master Machinist Geo. A. Wilson of the Washington Navy Yard; and Chief Examiner J. B. Durnall of the Patent Office. Their decision was made after exhaustive investigation in the principal cities and manufactories; and from the fact that out of nine competing methods only one was considered worthy of mention in their report, and that in terms of almost enthusiastic admiration, the reader may judge that the relative objections and advantages are fairly stated in this brief review. Six of these elevators have been running for three years, uninterupted for repair, in the "Boreel" and "Morse" buildings, and similar ones are going up in other famous piles, such as the "Vanderbilt," "Mills,

"Kelly," &c. All of the United States buildings having elevators, and in short, nearly all the most valuable public buildings, hotels, fashionable stores, apartment houses, &c., to the number of thousands, in this and other American cities, contain specimens of hydraulic or steam elevators of the same admirable manufacture.

The new hydraulic elevator is indeed a prodigy of simplicity and automatic power, with simple gravitation of air and water for its only law and mode of action, and with a conspicuous absence of the objections heretofore observed, as well as of all others conceivable. It consists of an upright cylinder and piston, only about a foot in diameter, and half the height of the lift; two pipes and two valves. That is all, save the car with its hoist ropes and sheaves, and whatever means, natural or other, may be used to bring a head of water into connection with the cylinder. One of the two pipes is a circulating pipe which connects the two extremities of the cylinder, and affords a passage for the transfer of water from one end to the other—that is, from above the piston to below it. It is also the medium for the pressure of water from the other or hydraulic pipe; a pressure thus made at all times continuous and uniform on the top of the piston head, wherever it may be, in motion or at rest. This pressure (when not neutralized) forces down the piston, thereby drawing up the car by the hoist rope attached to the piston rod.

Let us first suppose the car at the top of the lift, and the piston consequently down at the bottom of the cylinder; or, the car stationary at any point in the lift, and the piston at a corresponding point in the cylinder. As the cylinder is always full of water, and the full head of pressure always on, wherever the piston may be, the only possible way for the piston to move in either direction is for the water to get out of its way through some outlet. To let the piston rise (pulled up by the weight in the descending car) it is only necessary to open a valve that closes the lower end of the circulating pipe, thus opening communication from the part of the cylinder above the piston to the part of the cylinder below it. This allows the water above the piston to be pressed out before it, and down and back into the cylinder under it. The steadiness and ease with which the piston follows up the receding water—which, in turn, follows it up as steadily beneath—can not be exceeded by any movement in art or nature. At the same time, the movement is graduated perfectly to the will of the operator, whatever the variation of load, by opening or contracting, more or less, the valve orifice through which water is transferred from the top to the bottom of the cylinder. No water is expended.

Finally, to force down the piston and hoist the car, the circulating valve before mentioned must, of course, be closed; but this only renders motion either way impossible, because an immoveable body of water without vent fills the cylinder both above and below the piston, and it might as well be solid iron, for the matter of allowing the piston to stir. Another of the simplest things in the world must be done, namely, to open a discharge valve from the lower part of the cylinder, when the water there, in flowing out, begins not only to make room for the descent of the piston, but to make a vacuum beneath it which brings the atmospheric pressure upon the top of the piston, in addition to the pressure of the hydraulic column, which is never withdrawn. The descent is the same perfectly balanced, steady, soft and *fluid* motion previously noticed in the ascent; graduated likewise to perfection by controlling the size of the orifice with the valve rope in the hands of the operator in the car. The symplicity of the valve motion is also very beautiful. The two valves are simply two plugs a few inches apart on one stem, fitted inside a pipe, and drawn up or down by an easy motion of the hand rope. They are so adjusted with the orifices of circulation and discharge, respectively, that while they are at an intermediate position, all motion of water, and consequently of piston and car, is blocked; if lifted, they gradually and simultaneously open the discharge and close the circulation orifice, as much or little as the operator pleases, causing and graduating descent of piston and ascent of car; or if lowered, they cut off dicharge absolutely, and open circulation as gradually as desired, causing ascent of piston and descent of car.

The multiplication of the piston motion two or three fold in that of the car (which is all that can be necessary in the highest buildings with these long-cylinder machines) is done by single pairs of sheaves, and consequently without making the ropes cross the plane of revolution of their sheaves, and therefore without special friction, as well as without special strain and wear. All moves easily, naturally, straightforwardly, imperturbably, like the silent music of the spheres. The power, unlike that of steam, is as definitely limited and as invariable under all circumstances as the weight of so many cubic feet of water, with which the entire motive apparatus is exactly filled at every moment, never a drop less or a drop more, or the space of a drop vacant. The chances of breaking anything are reduced to a minimum so remote as to be hardly more than metaphysical; and yet all the standard safety appliances stand on guard against that conceptual possibility, so that there is probably no other kind of vehicle or mode of motion on sea or land so safe as that of the new hydraulic elevators above described. It is estimated that thirty millions of passengers are now annually conveyed to and from the upper stories of buildings in the elevators recorded on the salesbooks of Otis Brothers & Co. Up to the present time, this inconceivable amount of passenger business has been performed without a single reported instance of injury to life or limb from the failure of any part of the machinery. The fact is, so far as we know, without a parallel in the history of machinery, and may well direct earnest attention not only to the general qualities, but to the special features, of these remarkable machines.

OXIDIZED OIL.

To welcome a new industry is always an agreeable task, but special interest is attached to those instances in which the application of scientific principles have contributed to the results.

We have now to record a few facts relating to a means of manipulating oils, which result in the formation of a substance which has many of the advantages and characteristics of Rubber, but which can be manufactured at a fraction of its cost.

Reduced cost in the manufacture of a staple article, where a monopoly can be secured, naturally suggests great profits, and as capitalists are now competing for the privilege of manufacturing this new material, a few words respecting its nature and properties may be acceptable to our readers.

A few years ago a man of studious habits and inventive genius noticed that around the mouth of a can of oil, the oil had acquired the property of solidity, and finding that the effect was due to the oxidation of the oil, he conceived the idea of turning this property of linseed oil to practical account for various purposes in the Arts and Manufactures.

Mr. Frederick Walton, (for that was the name of the gentleman to whom we have referred) occupied several years in studying this subject, and making practical experiments relating to the behavior of oils under various conditions, and at length arrived at such successful results as to warrant his reading a paper before the London "Society of Arts," entitled "Introduction and Use of Elastic Gums and Analogous Substances." In this paper, after discussing the sources and qualities of india-rubber and gutta-percha, he described a method which he had invented of manufacturing an artificial product, which not only possessed the principal qualities of Caoutchouc and